

Above and Beyond

Jade Engineered Plastics and 3M team up to help customer reinvigorate successful product line

Industries as varied as pulp and paper, petrochemical and food processing depend on ball valves for precise flow control. From hot water or steam to aggressive and flammable chemicals, fluids must be delivered accurately and without contamination. Versatile ball valves are the optimal choice for precise on/off control. Their rapid shutoff capabilities and tight seals ensure both product quality and aid in worker safety. For a ball valve to work properly, though, its valve seat must be properly engineered and perfectly fitted.

Such specialized valve seats are among the many fluoropolymer parts made by Jade Engineered Plastics, a premier automatic compression molding manufacturer. One of Jade's customers produces ball valves for use across many industries. This customer had been using valve seats made from PTFE, but that fluoropolymer presented a problem: it did not provide sufficient resistance to deformation, wear and permeation. It also had a tendency to swell and contract, making for an imperfect seal.

The power of collaboration

Jade and 3M collaborated on changing the valve seat material to 3M™ Dyneon™ TFM™ PTFE, a modified grade of polytetrafluoroethylene which possesses much greater deformation resistance and a lower permeation rate than standard PTFE grades. It is stiffer and better resists permanent deformation; it also delivers a smoother surface finish, which in turn reduces friction and improves the ball-to-seat seal. TFM demonstrates improved coalescence during sintering, the final step in the manufacturing process. The improved fusion is advantageous both for mechanical properties and void reduction/permeation.

Working with this material, however, can pose its own challenges. A minor disadvantage of modified PTFE is sintering dimensional stability, and this post-sintered dimensional instability could result in a faulty product. Without a perfect fit and seal, the valve could leak the very substances it is meant to control.

Jade needed an additive to impart stability to the TFM compound. Working with their customer, they developed a proprietary engineered filler to optimize stability and improve wear resistance – without compromising friction, permeation or chemical resistance. Now the challenge was to come up with a practical formulation. They needed to strike a perfect balance: too much of the additive would affect the permeation resistance and modulus of the seal; too little, and the TFM would be dimensionally difficult.

After an extensive series of trials at the 3M Custom Compounding facilities in Aston, Pennsylvania, 3M developed a formulation that Jade and its customer determined to be optimal for their need. Because the physical characteristics of the new material are somewhat different than the previous PTFE material, Jade designed new seat geometries so their customer would not need to re-tool their own product.

New opportunities

The new seat was successful: it offered better permeation resistance, improved dimensional stability and enhanced structural integrity. Jade now manufactures these valve seats in sizes from ¾ to 54 inches in diameter. The process is still as much an art as a science; 3M and Jade employ their expertise throughout the compounding and molding process. The results, though, are well worth the effort. The redesigned product has opened new opportunities for Jade's customer, with applications in chemical processing, ethanol, oil and gas, railroad, paper and food industries.

The new valve's added value is made possible by the technical collaboration between Jade, the end user, and 3M Custom Compounding – and by that restless spirit of innovation that can never be satisfied with “good enough.”

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